

WATER RESOURCES REVIEW for

JUNE
1974

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

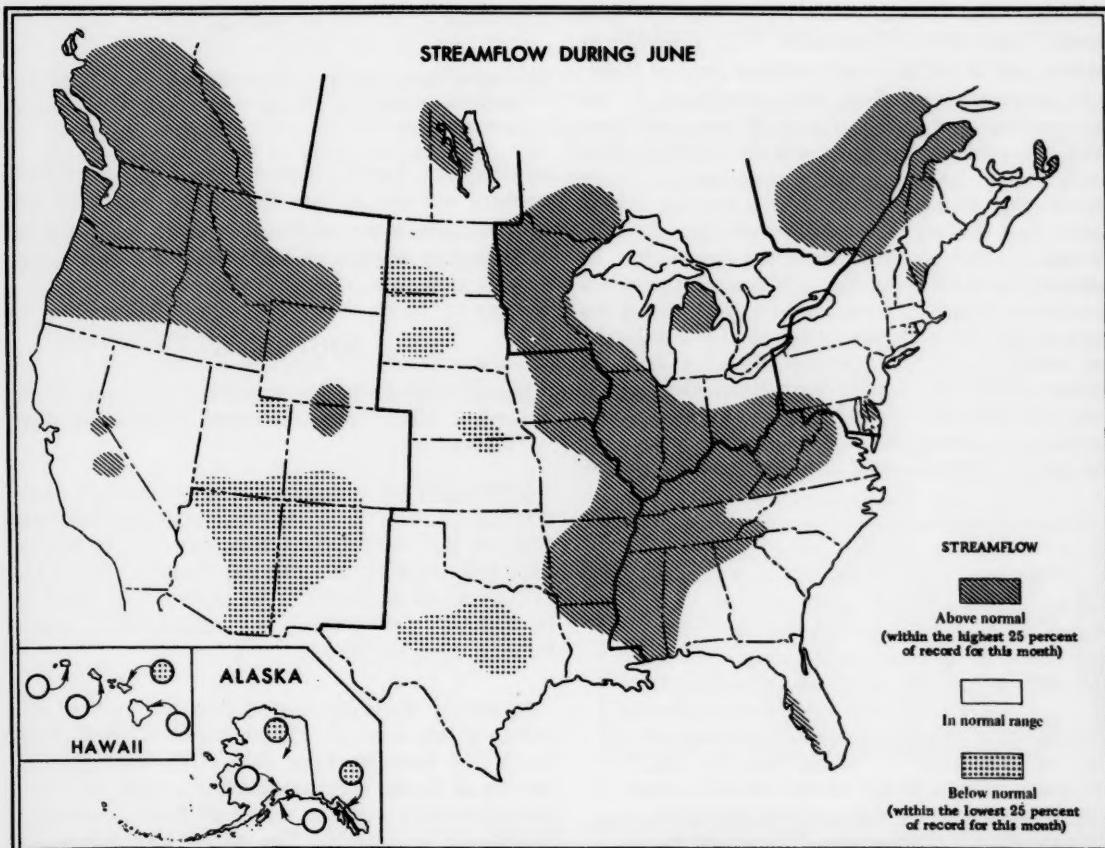
CANADA
DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES BRANCH

STREAMFLOW AND GROUND-WATER CONDITIONS

Streamflow decreased seasonally in much of southeastern Canada and the United States, but increased in parts of the central and western Provinces and in several east-central and northwestern States, and Alaska. Flows remained above the normal range in parts of the central and northwestern States and southern Canada. Monthly and daily mean discharges were highest of record at several index stations.

Extreme snowmelt flooding occurred in Idaho, Montana, and Washington, where some peak discharges exceeded those of the 200-year flood. Severe flooding occurred also in Arkansas, Louisiana, and Oklahoma, as a result of intense rains. Moderate to minor flooding occurred in Florida, Kentucky, and Tennessee, in the Southeast; Illinois, Indiana, Minnesota, Ohio, and Wisconsin, in the Western Great Lakes region; and Iowa, Missouri, Nebraska, and Texas, in the Midcontinent.

Monthly mean discharge of Mississippi River near Vicksburg, Miss., was more than twice the median flow for June, and about 40 percent greater than the flow during May, as a result of large tributary inflows from the Ohio River basin, and from Arkansas, Louisiana, Tennessee, and Mississippi.



CONTENTS OF THIS ISSUE: Northeast, Southeast, Western Great Lakes region, Midcontinent, West; Usable contents of selected reservoirs near end of June 1974; Flow of large rivers during June 1974; Publications on techniques of water-resources investigations; Alaska, Hawaii; Water demands for expanding energy development.

NORTHEAST

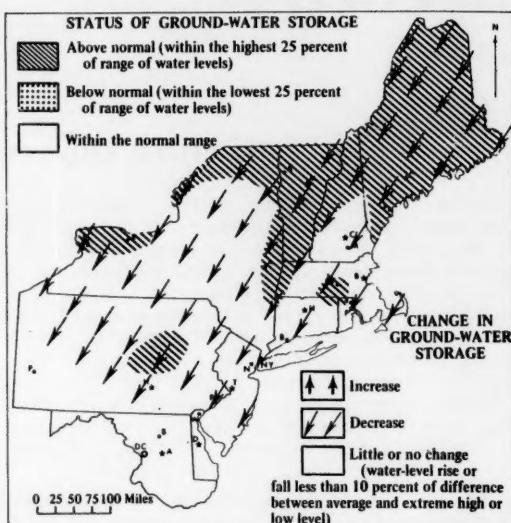
[Atlantic Provinces and Quebec; Delaware, Maryland, New York, New Jersey, Pennsylvania, and the New England States]

STREAMFLOW GENERALLY DECREASED SEASONALLY IN ALL PARTS OF THE REGION BUT REMAINED ABOVE THE NORMAL RANGE IN A LARGE AREA CENTERED ON SOUTHEASTERN QUEBEC. FLOWS WERE ABOVE NORMAL ALSO IN PARTS OF NOVA SCOTIA, MAINE, AND MARYLAND, AND WERE BELOW NORMAL IN PARTS OF CONNECTICUT AND NEW YORK.

In the Outardes River basin in northeastern Quebec, where snowmelt runoff during May was retarded by below-normal temperatures and snowpack at the beginning of June was unusually heavy, a sharply rising temperature trend during June, accompanied by intermittent rains, resulted in a monthly mean discharge of 66,900 cfs at the index station at Outardes Falls (drainage area, 7,230 square miles). This was the largest monthly mean discharge observed at that site since records began there in September 1922. Elsewhere in Quebec, and in northern and southern parts of Maine, high carryover flows from May contributed to the above-normal June flows that generally were more than twice the medians for the month. In northern Nova Scotia, where streamflow was near median and in the normal range during May, the seasonal decrease in flow during June was less than usual and the mean flow for the month was more than double the June median. In extreme eastern Maryland, flow of Choptank Creek near Greensboro increased contraseasonally, remained in the above-normal range for the 2d consecutive month, and was nearly 4 times the median flow for June. In northern New York, flow of West Branch Oswegatchie River near Harrisville decreased sharply, from the above-normal range during May, to near median during June (see graph). Below-normal flows occurred in western

flows have been below median for 4 consecutive months.

Ground-water levels declined in most of the region (see map), but rose or changed only slightly in Delaware



Map above shows ground-water storage near end of June and change in ground-water storage from end of May to end of June.

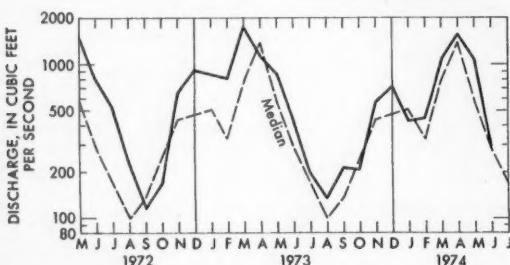
and Maryland. Levels remained above normal in most of northern and central New England, as well as in the extreme northern part of New York State. In other parts of the region, monthend levels in most wells were within the normal range.

SOUTHEAST

[Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia]

STREAMFLOW GENERALLY DECREASED SEASONALLY IN THE EASTERN STATES OF THE REGION BUT INCREASED IN PARTS OF THE WESTERN AND NORTHERN STATES AND IN CENTRAL FLORIDA AS A RESULT OF LOCALIZED RAINS. FLOODING OCCURRED IN KENTUCKY, TENNESSEE, AND FLORIDA.

In eastern Kentucky, runoff from as much as 5½ inches of rain June 21, 22, resulted in flooding along North Fork Kentucky River. Parts of the flood plain in the city of Hazard were inundated to a depth of 5 feet when the river crested at a stage of 26.98 feet (discharge, 31,100 cfs) on June 22. The highest stage previously observed at the Hazard gaging station, since records began in January 1940, was 37.54 feet, January 29, 1957. In western and central Tennessee, runoff from



Monthly mean discharge of West Branch Oswegatchie River near Harrisville, N.Y. (Drainage area, 258 sq mi; 668 sq km)

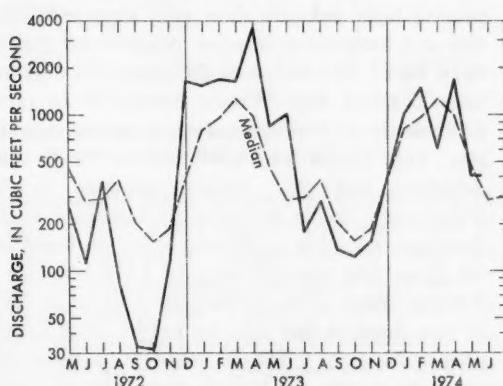
Long Island, New York, and also in the Mount Hope River basin in eastern Connecticut, where monthly mean

intense rain June 1, 2, caused flooding of lowlands along some major streams. The monthly mean discharge of 8,748 cfs, and the daily mean of 23,900 cfs on the 3d, at the index station on Duck River above Hurricane Mills (drainage area, 2,557 square miles), were the highest, respectively, for June in record that began in July 1925. Also in west-central Tennessee, monthly mean flow of Harpeth River near Kingston Springs increased sharply, was more than 10 times the June median, and was above the normal range. In Florida, severe flooding occurred along the central and southern parts of the Gulf coast as a result of runoff and ponding caused by 10 to 15 inches of rain during the period June 22 to 27. Damage was estimated at about 25 million dollars in those areas. Only minor flooding and damage was reported in inland areas.

In north-central Florida, discharge of Silver Springs decreased 5 cfs, to 665 cfs; 87 percent of normal. Also in northern Florida, monthly mean flow of Suwannee River at Branford decreased seasonally and remained in the normal range where it has been for 10 consecutive months. In the south-central part of the State, flow of Peace River at Arcadia increased seasonally and was greater than the monthly median for the first time in 10 months. In southern Florida, flow southward through the Tamiami Canal outlets, 40-mile bend to Monroe, increased from 0.5 cfs during May to 145 cfs (213 percent of normal) during June. In southeastern Florida, flow of Miami Canal at Miami increased from 4.6 cfs during May to 110 cfs (34 percent of normal) during June.

In Mississippi, western Tennessee, Kentucky, and West Virginia, monthly mean flows at index stations generally increased contraseasonally, were above the normal range, and ranged from about 3 to about 10 times their respective June medians.

In south-central Alabama, flow of Conecuh River at Brantley was essentially unchanged from May and was slightly greater than median (see graph).



Monthly mean discharge of Conecuh River at Brantley, Ala.
(Drainage area, 492 sq mi; 1,274 sq km)

Ground-water levels declined seasonally in most of the Southeast; but levels changed only slightly in northern Virginia and eastern North Carolina; and rose in the central three-quarters of West Virginia as well as in much of Kentucky (other than the central section) and in northern and central Florida. Monthend levels were below average in central Kentucky and above average elsewhere in the State as well as in most of West Virginia. Monthend levels were near or above average in North Carolina and northern Florida; and were below average in southeastern Florida.

WESTERN GREAT LAKES REGION

[Ontario; Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin]

STREAMFLOW GENERALLY DECREASED SEASONALLY IN EASTERN AND CENTRAL PARTS OF THE REGION, BUT INCREASED, AND WAS ABOVE NORMAL, IN MANY SOUTHERN AND WESTERN BASINS. FLOWS ALSO WERE ABOVE NORMAL IN THE NORTHERN PART OF MICHIGAN'S LOWER PENINSULA. FLOODING OCCURRED IN PARTS OF ILLINOIS, INDIANA, MINNESOTA, OHIO, AND WISCONSIN.

In Illinois, runoff from thunderstorms caused moderate flooding in numerous stream basins during the first three weeks in June. In the north-central part of the State, record flooding occurred along small streams June 21, 22, and resulted in extensive damage in Peoria, Pekin, and surrounding towns. The peak stage on Kickapoo Creek at Peoria was the highest observed at that gaging station since records began in 1942. Record-high discharges occurred along Spoon River, west of Peoria, as a result of the June 21, 22 storm. The peak discharge of 39,000 cfs June 23 at London Mills was the highest in record that began in 1942, and the peak of 37,500 cfs June 24 at Seville was the highest since records began in 1914. Monthly mean discharges at index stations in northern and central parts of the State remained in the above-normal range and were 3 to 4 times greater than their respective June median flows.

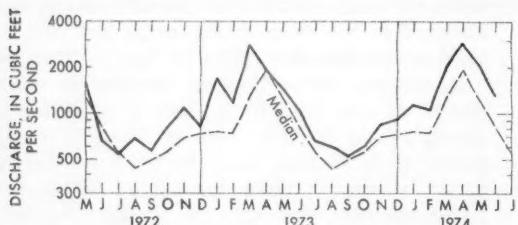
In Indiana, minor flooding occurred in the upper reaches of East Fork White River basin, in the southeastern part of the State. Property damage was confined mostly to agricultural areas. In the lower part of the basin, the monthly mean discharge at Shoals increased contraseasonally, was above the normal range, and was more than twice the median flow for June.

In north-central Minnesota, the peak discharge of 61,000 cfs (gage height, 19 feet) on Rainy River at Manitou Rapids, June 9 and 10, was the 2d highest since records began in July 1928. The maximum discharge of record is 71,600 cfs (gage height, 21.04 feet) May 12, 1950. In the southeastern part of the State, flooding occurred in the Whitewater and Zumbro River basins.

North Fork Whitewater River near Elba crested at a stage of 16.38 feet June 20, 7.82 feet higher than the previous maximum in 11 years of record. South Fork Whitewater River near Altura crested June 21 at gage height 10.61 feet, which is equal to the previous maximum in record beginning in 1939. Flooding along Bear Creek and Silver Creek, tributaries of South Fork Zumbro River, in the city of Rochester, caused several families to evacuate their homes. South Fork Zumbro River crested June 21 at the gaging station downstream from Rochester at gage height, 16.86 feet, 2.26 feet lower than the maximum stage observed at that site since records began in 1952. Monthly mean discharges at the index stations, Crow River at Rockford and Buffalo River near Dilworth, in central and western Minnesota, respectively, and those of Minnesota River near Jordan and Mississippi River at St. Paul, were in the above-normal range.

In southwestern Wisconsin, runoff from intense rain resulted in a peak discharge of 8,800 cfs June 20 on Grant River at Burton (drainage area, 267 square miles). The daily mean flow on June 19 at that site was 200 cfs. In the southern part of the State, some lake levels were highest of record near monthend. The observed stage of 15.62 feet, June 22, on North Lake near Elkhorn, was 3.17 feet higher than the previous maximum stage observed there in 37 years of record. In northern Wisconsin, runoff from above-normal precipitation reversed the usual seasonal decline in streamflow and monthly mean discharges generally were about the same or greater than mean flows during May.

In Michigan, flows decreased at all index stations and were in the normal range except on Muskegon River at Evart, in the northern part of the southern peninsula, where monthly mean discharge remained in the above-normal range for the 6th consecutive month (see graph).



Monthly mean discharge of Muskegon River at Evart, Mich.
(Drainage area, 1,450 sq mi; 3,760 sq km)

With the exception of April 1973, monthly mean flows at that station have been greater than median continuously since August 1972.

Ground-water levels in water-table wells rose in Wisconsin, southern Minnesota, west-central Indiana, and

most of Michigan; and declined in the southern part of Michigan's Lower Peninsula and in northern Minnesota and most of Indiana. Monthend levels were above average in Minnesota, Wisconsin, and Michigan, and were near average in Indiana and Ohio. In Minnesota, levels in wells tapping artesian aquifers underlying the Minneapolis-St. Paul area, continued to decline and remained below average.

MIDCONTINENT

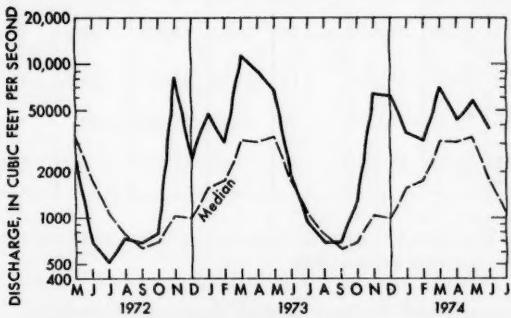
[Manitoba and Saskatchewan; Arkansas, Iowa, Kansas, Louisiana, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota, and Texas]

STREAMFLOW GENERALLY INCREASED AND WAS ABOVE THE NORMAL RANGE IN THE EASTERN PART OF THE REGION AND IN SOUTHERN MANITOBA IN THE NORTH, BUT DECREASED IN MOST WESTERN AND SOUTHERN BASINS. FLOWS WERE BELOW THE NORMAL RANGE IN PARTS OF NORTH DAKOTA, SOUTH DAKOTA, NEBRASKA, KANSAS, AND TEXAS. SEVERE FLOODING OCCURRED IN ARKANSAS, LOUISIANA, AND OKLAHOMA, AND MODERATE TO MINOR FLOODING WAS REPORTED IN PARTS OF IOWA, MISSOURI, NEBRASKA, AND TEXAS.

Severe flooding occurred in Oklahoma, Arkansas, and Louisiana June 8-12 as a result of runoff from heavy and intense rains June 7-9. As much as 15 inches of rain was reported unofficially in the El Dorado-Junction City area of extreme south-central Arkansas, and more than 9 inches reportedly fell in about 6 hours during the night of June 8, 9 at Siloam Springs in northwestern Arkansas. Many homes and businesses were inundated and transportation was disrupted because of flooded highways and railways, and flood-damaged bridges. The accompanying table and map show peak stage and discharge data and locations of selected measurement sites in the three States. In addition to the stream flooding, runoff from localized, high-intensity thunderstorms exceeded the capacity of drainage systems in several cities in the area. Four deaths were attributed to the flooding in Arkansas, and four persons drowned in Bayou D'Arbonne Lake in north-central Louisiana. In Texas, flooding occurred in small areas in the northwest part of the State. The peak discharge of 1,900 cfs June 4 on Running Water Draw at Plainview is equal to that of a 10-year flood at that site. On nearby Duck Creek, the peak discharge of 4,900 cfs June 4, at the gaging station near Girard, was the highest peak flow since records began in 1964. In Nebraska, localized flash flooding in some central and eastern basins was reported during the first half of the month, and in northern Missouri,

moderate flooding occurred in the Grand, Platte, and Salt River basins June 1 to 12. In southeastern Kansas, minor flooding was reported in Verdigris River basin June 6, 7. In central Iowa, the peak stages of 17.57 feet on Timber Creek near Marshalltown, 17.09 feet on Walnut Creek near Des Moines, and 14.06 feet on Fourmile Creek at Des Moines, resulted in minor flooding on June 9 in those basins. The related peak discharges of 8,100 cfs on Timber Creek and 7,100 cfs on Walnut Creek, are equal to 20-year and 25-year floods, respectively, at those sites.

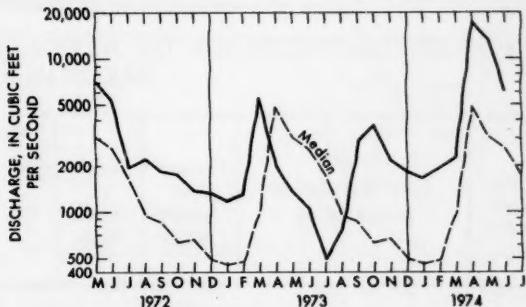
In northeastern Iowa, monthly mean discharge of Cedar River at Cedar Rapids remained above the normal range for the 9th consecutive month. Cumulative runoff during that period was about two times the median. In the southwestern part of the State, flow of Nishnabotna River above Hamburg decreased sharply, from the above-normal range during May, to near the median discharge for June. Flows also decreased sharply in Kansas during the last half of the month, as typified by Little Blue River near Barnes, where the monthly mean discharge decreased contraseasonally and was only 42 percent of the median flow for June. In southern Missouri, high carryover flow from May helped to diminish the usual seasonal decrease in flow during June on Gasconade River at Jerome, where the monthly mean discharge was more than double the median flow (see graph).



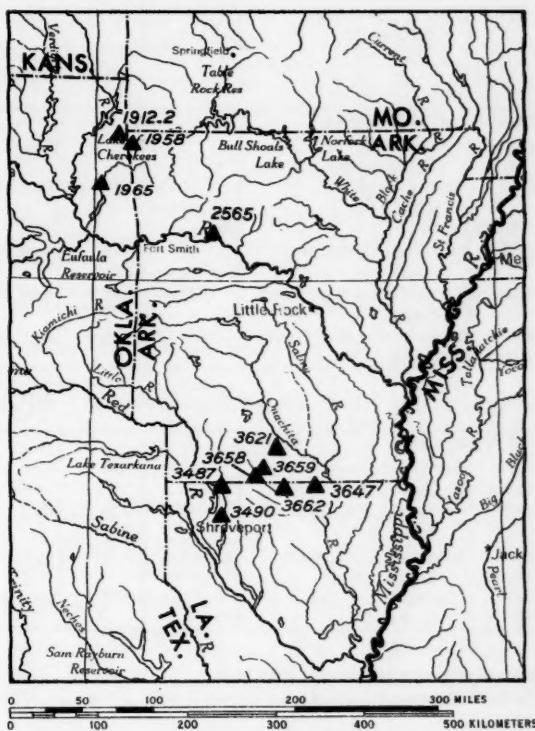
Monthly mean discharge of Gasconade River at Jerome, Mo.
(Drainage area, 2,840 sq mi; 7,360 sq km)

In southwestern South Dakota, monthly mean flow of Bad River near Ft. Pierre decreased contraseasonally to less than 6 percent of median flow for June, and reflected the dry conditions in that part of the State.

In North Dakota, flow of Red River of the North at Grand Forks decreased seasonally but remained in the above-normal range for the 10th consecutive month (see graph). Cumulative runoff during the first 9 months of the 1974 water year at that site was nearly 3 times the median runoff for the period.



Monthly mean discharge of Red River of the North at Grand Forks, N. Dak. (Drainage area, 30,100 sq mi; 78,000 sq km)



Location of stream-gaging stations described in table of peak stages and discharges on page 6.

In Manitoba, flow at the index station, Waterhen River below Waterhen Lake, increased seasonally and was above the normal range for the 2d consecutive month. The level of Lake Winnipeg at Gimli averaged 717.91 feet above mean sea level, 4.07 feet above the long-term mean for June, and 1.23 feet higher than last month.

Ground-water levels rose in North Dakota; remained about the same or declined slightly in Iowa and Kansas; and continued to fall in Nebraska except for rises in alluvial aquifers in the northwestern part of the State

Provisional data; subject to revision

STAGES AND DISCHARGES FOR THE FLOODS OF JUNE 1974 AT SELECTED SITES IN OKLAHOMA, ARKANSAS, AND LOUISIANA

WRD station number	Stream and place of determination	Drainage area (square miles)	Period of known floods	Maximum flood previously known			Maximum during present flood				
				Date	Stage (feet)	Discharge (cfs)	Date	Stage (feet)	Discharge		Recurrence interval (years)
									Cfs	Cfs per square mile	

OKLAHOMA

ARKANSAS RIVER BASIN												
07-1912.20	Spavinaw Creek near Sycamore.	133	1962-	Nov. 24, 1973	17.36	18,100	June 8	^a 17.54	20,000	151	30	
07-1965	Illinois River near Tahlequah.	959	1935-	May 10, 1950	27.94	150,000		8	23.02	71,000	74.2	15

ARKANSAS

ARKANSAS RIVER BASIN												
07-1958	Flint Creek at Springtown.	14.2	1961-	Aug. 14, 1961	14.75	6,730	June 8	17.66	12,500	880	^b 1.4	
07-2565	Spadra Creek at Clarksville.	61.1	1953-	Dec. 10, 1971	16.54	18,000		5	19.2	26,500	434	^b 1.4
RED RIVER BASIN												
07-3621	Smackover Creek near Smackover.	377	1958, 1961-	^c Apr. 27, 1958	21.21	25,000		8	24.98	55,000	146	^b 2
07-3658	Cornie Bayou near Three Creeks.	180	1956-	Apr. 27, 1958	^d 15.50	35,800		9	17.5	74,000	411	^b 3.3
07-3659	Three Creeks near Three Creeks.	50.3	1956-	Apr. 26, 1958	^d 9.35	11,300		9	12.7	30,000	596	^b 3.1

LOUISIANA

RED RIVER BASIN												
07-3487	Bayou Dorcheat near Springhill.	605	1958-	Apr. 28, 1958	22.79	36,400	June 10	20.81	29,900	49.4	25+	
07-3490	Bayou Dorcheat near Minden.	1,097	1929-31, 1937-	May 1, 1958	24.90	44,800		12	23.31	27,300	24.9	10+
07-3647	Bayou de Loutre near Laran.	141	1956-	Apr. 27, 1958	20.29	22,600		9	20.43	24,200	172	50+
07-3662	Little Corney Bayou near Lillie.	208	1956-	Apr. 28, 1958	16.52	21,400		9	17.65	24,200	116	50+

^aSecond highest stage since at least 1920.

^bRatio of discharge to that of the 50-year flood.

^cMaximum stage since at least 1938; from records of Corps of Engineers.

^dMaximum stage since at least 1880.

caused by recharge from locally heavy storm rainfall. Monthend levels were near average in North Dakota and below average in Nebraska. In the rice-growing area of east-central Arkansas, the level in the shallow aquifer (Quaternary deposits) was unchanged and within the same range of June levels that have prevailed since 1965. In the industrial aquifer of central and southern Arkansas (Sparta Sand), levels changed very little at Pine Bluff and declined at El Dorado; monthend levels were below average in both areas. In northern Louisiana, levels changed only slightly; in the Chicot aquifer in the southwestern part of the State, levels continued to decline in response to seasonal pumping for irrigation. In Texas, levels declined at Austin (Edwards Limestone), Houston (Evangeline aquifer), San Antonio (Edwards

Limestone), and El Paso (bolson deposits). Monthend levels were above average at Austin (new June high in 30-year record) and San Antonio; and at lowest levels of record at Houston (new monthly low for June) and El Paso (all-time low).

WEST

[Alberta and British Columbia; Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming]

STREAMFLOW GENERALLY INCREASED AND REMAINED IN THE ABOVE-NORMAL RANGE IN THE NORTHWESTERN PART OF THE REGION, BUT GENERALLY DECREASED IN THE CENTRAL,

USABLE CONTENTS OF SELECTED RESERVOIRS NEAR END OF JUNE 1974

[Contents are expressed in percent of reservoir capacity. The usable storage capacity of each reservoir is shown in the column headed "Normal maximum."]

Principal uses: F—Flood control I—Irrigation M—Municipal P—Power R—Recreation W—Industrial	Reservoir				Normal maximum	Reservoir				Normal maximum												
	End of May 1974	End of June 1974	End of June 1973	Average for end of June		End of May 1974	End of June 1974	End of June 1973	Average for end of June													
	Percent of normal maximum					Percent of normal maximum																
NORTHEAST REGION																						
NOVA SCOTIA																						
Rossignol, Mulgrave, Falls Lake, St. Margaret's Bay, Black, and Ponhook Reservoirs (P)	78	72	81	71	223,400 (a)	MIDCONTINENT REGION																
QUEBEC																						
Gouin (P)	87	92	77	64	6,954,000 ac-ft	NORTH DAKOTA																
Allard (P)	97	93	90	82	280,600 ac-ft	Lake Sakakawea (Garrison) (FIPR)	85	95	98	22,640,000 ac-ft												
MAINE						NEBRASKA																
Seven reservoir systems (MP)	96	96	97	86	178,489 mcf	Lake McComaughy (IP)	83	84	92	1,948,000 ac-ft												
NEW HAMPSHIRE						OKLAHOMA																
Lake Winnipesaukee (PR)	103	101	117	96	7,200 mcf	Keystone (FPR)	133	122	92	661,000 ac-ft												
Lake Francis (FPR)	96	94	97	87	4,326 mcf	Lake O' The Cherokees (FPR)	97	101	99	1,492,000 ac-ft												
First Connecticut Lake (P)	94	89	96	90	3,330 mcf	Tenkiller Ferry (FPR)	101	120	107	98,200 ac-ft												
VERMONT						Lake Altus (FIMR)	62	63	75	134,500 ac-ft												
Somerset (P)	98	99	91	86	2,500 mcf	Eufaula (FPR)	103	108	107	2,378,000 ac-ft												
Harriman (P)	90	88	84	83	5,060 mcf	OKLAHOMA—TEXAS																
MASSACHUSETTS						Lake Texoma (FMPRW)	101	100	105	2,722,000 ac-ft												
Cobble Mountain and Borden Brook (MP)	89	86	91	88	3,394 mcf	TEXAS																
NEW YORK						Possum Kingdom (IMPRW)	83	85	92	724,500 ac-ft												
Great Sacandaga Lake (FPR)	100	93	92	92	34,270 mcf	Buchanan (IMPW)	86	84	75	955,200 ac-ft												
Indian Lake (FMP)	104	108	103	101	4,500 mcf	Bridgeport (IMW)	54	50	62	386,400 ac-ft												
New York City reservoir system (MW)	100	96	99	—	547,500 mg	Eagle Mountain (IMW)	91	90	99	190,300 ac-ft												
NEW JERSEY						Medina Lake (I)	100	97	100	51												
Wanaque (M)	99	93	95	86	27,730 mg	Lake Travis (FIMPRW)	98	91	97	254,000 ac-ft												
PENNSYLVANIA						Lake Kemp (IMW)	52	55	50	82												
Wallenpaupack (P)	86	84	85	80	6,875 mcf	THE WEST																
Pymatuning (FMR)	100	98	98	97	8,191 mcf	ALBERTA																
MARYLAND						Spray (P)	—	57	57	210,000 ac-ft												
Baltimore municipal system (M)	100	100	100	92	85,340 mg	Lake Minnewanka (P)	—	91	60	199,700 ac-ft												
SOUTHEAST REGION						St. Mary (I)	—	96	92	320,800 ac-ft												
NORTH CAROLINA						WASHINGTON																
Bridgewater (Lake James) (P)	95	97	99	90	12,580 mcf	Franklin D. Roosevelt Lake (IP)	17	94	58	97												
High Rock Lake (P)	93	92	89	77	10,230 mcf	Lake Chelan (PR)	55	93	93	97												
Narrows (Badin Lake) (P)	98	98	96	98	5,616 mcf	IDAHO—WYOMING																
SOUTH CAROLINA						Upper Snake River (7 reservoirs) (IMP)	63	87	81	90												
Lake Murray (P)	94	90	95	78	70,300 mcf	WYOMING																
Lakes Marion and Moultrie (P)	87	86	92	72	81,100 mcf	Pathfinder, Seminoe, Alcova, Kortes, Glendo, and Guernsey Reservoirs (I)	78	82	94	59												
SOUTH CAROLINA—GEORGIA						Buffalo Bill (IP)	49	108	82	104												
Clark Hill (FP)	77	76	77	73	75,360 mcf	Boysen (FIP)	67	98	94	90												
GEORGIA						Keyhole (F)	83	82	86	43												
Burton (PR)	100	98	100	90	104,000 ac-ft	COLORADO																
Lake Sidney Lanier (FMPR)	68	66	66	62	1,686,000 ac-ft	John Martin (FIR)	0	0	0	21												
Sinclair (MPR)	91	90	94	91	214,000 ac-ft	Colorado—Big Thompson project (I)	91	98	98	75												
ALABAMA						Taylor Park (IR)	81	93	89	98												
Lake Martin (P)	98	99	100	91	1,373,000 ac-ft	COLORADO RIVER STORAGE PROJECT																
TENNESSEE VALLEY						Lake Powell; Flaming Gorge, Navajo, and Blue Mesa Reservoirs (IFPR)	78	81	70	—												
Clinch Projects: Norris and Melton Hill Lakes (FPR)	68	69	75	61	1,156,000 cfsd	UTAH—IDAHO																
Holston Projects: South Holston, Watauga, Boone, Fort Patrick Henry, and Cherokee Lakes (FPR)	85	86	86	66	1,452,000 cfsd	Bear Lake (IPR)	89	92	88	68												
Douglas Lake (FPR)	82	80	85	66	703,100 cfsd	CALIFORNIA																
Hawassee Projects: Chatuge, Nottely, Hiwassee, Apalachia, Blue Ridge, Ocoee 3, and Parksville Lakes (FPR)	87	85	92	80	512,200 cfsd	Hetch Hetchy (MP)	79	99	100	81												
Little Tennessee Projects: Nantahala, Thorpe, Fontana, and Chilhowee Lakes (FPR)	93	91	92	83	745,200 cfsd	Lake Almanor (P)	107	110	92	62												
WESTERN GREAT LAKES REGION						Shasta Lake (FIPR)	104	102	96	89												
WISCONSIN						Millerton Lake (FI)	88	96	100	83												
Chippewa and Flambeau (PR)	94	93	96	87	15,900 mcf	Pine Flat (FI)	92	96	94	69												
Wisconsin River (21 reservoirs) (PR)	80	91	91	82	17,400 mcf	Isabella (FIR)	71	86	72	44												
MINNESOTA						Folsom (FIP)	90	96	94	93												
Mississippi River headwater system (FMR)	42	47	31	40	1,640,000 ac-ft	Lake Berryessa (FIMW)	99	97	95	85												
						Clair Engle Lake (Lewiston) (P)	99	100	97	93												
ARIZONA—NEVADA						CALIFORNIA—NEVADA																
Lake Tahoe (IPR)	—	—	—	—	Lake Tahoe (IPR)	90	95	92	74													
Rye Patch (I)	—	—	—	—	NEVADA																	
ARIZONA—NEVADA						Rye Patch (I)	93	84	106	157,200 ac-ft												
Lake Mead and Lake Mohave (FIMP)	—	—	—	—	ARIZONA																	
San Carlos (IP)	42	36	—	—	Lake Mead and Lake Mohave (FIMP)	73	73	81	72													
Salt and Verde River system (IMPR)	67	56	—	—	ARIZONA																	
Conchas (FIR)	—	—	—	—	San Carlos (IP)	42	36	74	14													
Elephant Butte and Caballo (FIPR)	—	—	—	—	Salt and Verde River system (IMPR)	67	56	96	42													
NEW MEXICO						NEW MEXICO																
—	—	—	—	—	Conchas (FIR)	57	50	87	78													
—	—	—	—	—	Elephant Butte and Caballo (FIPR)	28	22	31	29													
						MISSOURI RIVER SYSTEM																
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²Thousands of kilowatt-hours

METRIC EQUIVALENTS OF UNITS USED IN THE WATER RESOURCES REVIEW

(Round-number conversions, to nearest four significant figures)

1 foot = 0.3048 metre 1 mile = 1.609 kilometres

1 acre = 0.4047 hectare = 4,047 square metres

1 square mile (sq mi) = 259 hectares = 2.59 square kilometres (sq km)

1 acre-foot (ac-ft) = 1,233 cubic metres

1 million cubic feet (mcf) = 28,320 cubic metres

1 cubic foot per second (cfs) = 0.02832 cubic metres per second = 1.699 cubic metres per minute

1 second-foot-day (cfsd) = 2,447 cubic metres per day

1 million gallons (mg) = 3,785 cubic metres = 3.785 million litres

1 million gallons per day (mgd) = 694.4 gallons per minute (gpm) = 24,385 cubic feet per minute

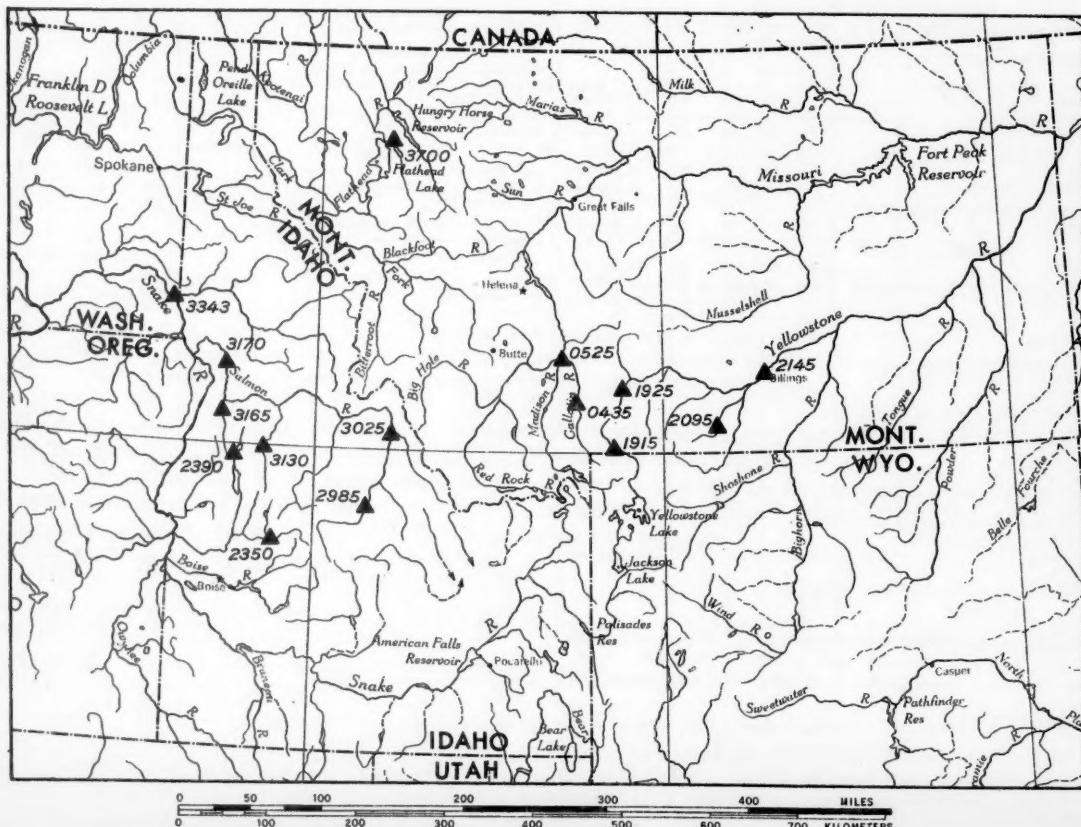
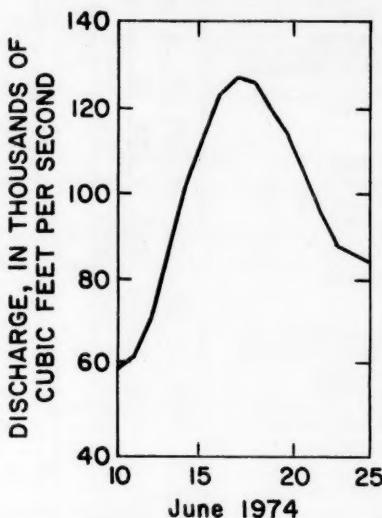
minute = 3,785 cubic metres per day

SOUTHERN, AND COASTAL STATES. FLOWS REMAINED BELOW NORMAL IN LARGE AREAS IN ARIZONA AND NEW MEXICO. SNOWMELT FLOODING OCCURRED IN PARTS OF IDAHO, MONTANA, AND WASHINGTON.

Temperatures were below normal in the high-altitude basins of Idaho and Montana during May and the first part of June, thereby retarding snowmelt and compressing the seasonal runoff period. Snowpack in many basins was reported to be more than double the normal on June 1. A rapidly-rising temperature trend began about June 10 in western Idaho and record-high temperatures were observed in both States about midmonth. The resulting snowmelt runoff, augmented by thunderstorms in some basins at lower altitudes, caused extensive flooding in the two States. Some flooding occurred also along the main stem of Snake River near the Idaho-Washington border. The accompanying table and map show peak stage and discharge data and locations of selected measurement sites in the flood area. In addition to the peak stages and discharges, that were highest of record on many streams, some monthly and daily mean discharges also were greater than any previously observed. For example, on Salmon River at White Bird (drainage area, 13,550 square miles), in west-central Idaho, the monthly mean of 84,900 cfs, and the daily

mean of 127,000 cfs on the 17th, were the highest observed in any month during 62 years of record. The accompanying hydrograph of daily mean discharges for

Salmon River at White Bird, Idaho



Location of stream-gaging stations described in table of peak stages and discharges on page 9.

Provisional data; subject to revision

**STAGES AND DISCHARGES FOR THE FLOODS OF JUNE 1974 AT SELECTED SITES IN MONTANA,
IDAHO, AND WASHINGTON**

WRD station number	Stream and place of determination	Drainage area (square miles)	Period of known floods	Maximum flood previously known			Maximum during present flood				
				Date	Stage (feet)	Dis- charge (cfs)	Date	Stage (feet)	Discharge		Recurrence interval (years)
									Cfs	Cfs per square mile	

MONTANA

GALLATIN RIVER BASIN												
06-0435	Gallatin River near Gallatin Gateway.	825	1890-94, 1931-	June 27, 1971	6.49	9,270	June 18	7.37	9,000	10.9	50	
06-0525	Gallatin River at Logan...	1,795	1895- 1905, 1929-	June 21, 1899	a6.25	9,840	18	8.8	8,780	4.9	50	
YELLOWSTONE RIVER BASIN												
06-1915	Yellowstone River at Corwin Springs.	2,623	1890-93, 1911- 1918	June 14, 15,	11.5	32,000	17	10.7	31,000	11.8	50+	
06-1925	Yellowstone River near Livingston.	2,551	1897- 1905, 1929-	June 20, 1943	9.34	30,600	19	9.20	36,000	14.1	50	
06-2095	Rock Creek near Red Lodge.	124	1932, 1934-	June 4, 1957	4.78	3,110	18	4.8	3,000	24.2	50	
06-2145	Yellowstone River at Billings.	11,795	1904-05, 1929-	June 16, 1967	14.76	66,100	19	14.1	70,000	5.9	50	
PEND OREILLE RIVER BASIN												
12-3700	Swan River near Bigfork...	671	1922-	May 24, 1948	7.12	8,400	20	(b)	8,900	13.3	50	

IDAHO

PAYETTE RIVER BASIN												
13-2350	South Fork Payette River at Lowman.	456	1941-	May 24, 1956	7.45	7,050	June 17	8.3	8,800	19.3	200+	
13-2390	North Fork Payette River at Mc Call.	144	1909-17, 1920-	June 4, 1948	7.71	4,260	18	8.04	4,670	32.4	200+	
SALMON RIVER BASIN												
13-2985	Salmon River near Challis.	1,800	1929-	May 25, 1956	10.95	15,400	17	11.55	18,400	10.2	100+	
13-3025	Salmon River at Salmon...	3,760	1912-16, 1920-	May 25, 1956	8.25	16,500	17	(b)	19,600	5.2	100+	
13-3130	Johnson Creek at Yellow Pine.	213	1929-	Jan. 8, 1942	c9.62	(b)	16	8.45	6,550	30.8	200+	
13-3165	Little Salmon River at Riggins.	576	1948, 1952-54, 1957-	May 27, 1956	7.64	5,440	17	(b)	12,600	21.9	200+	
13-3170	Salmon River at White Bird.	13,550	1894, 1911-17, 1920-	June 1, 1948	d37.5	120,000	17	35.8	128,000	9.4	200+	

WASHINGTON

SNAKE RIVER MAINSTEM												
13-3343	Snake River near Anatone.	92,960	1959-	May 29, 1971	19.98	151,000	June 19	e24.23	f213,000	2.3	.....

^aSite and datum then in use.

^bNot determined.

^cResult of ice jam.

^dAbout.

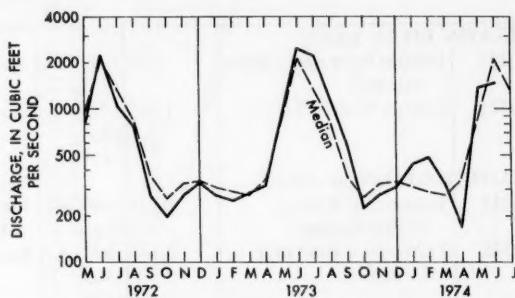
^eObserved near crest.

^fResult of current-meter measurement.

that gaging station shows the rapid increase in snowmelt runoff, June 11 to 17. Mean altitude of the basin upstream from White Bird is 6,720 feet, and datum of the gage at White Bird is 1,412.65 feet above mean sea level. Also in Idaho, monthly mean discharges on Clearwater River at Spalding, and Snake River near Heise, exceeded those of any previous month during the 52-year and 64-year records at those respective sites. In south-central Montana, the monthly mean flow of 41,460 cfs, and the daily mean of 67,800 cfs on the 19th, on Yellowstone River at Billings (drainage area, 11,795 square miles), were the highest for any month in 47 years of record. On Clark Fork at St. Regis (drainage area, 10,709 square miles) in the northwestern part of the State, the daily mean of 64,600 cfs on the 19th, was highest for June in 64 years of record, and on Middle Fork Flathead River near West Glacier (drainage area, 1,128 square miles), also in the northwest, the monthly mean of 20,450 cfs was the highest observed in June since records began in 1939. In Washington, rapid melting of the above-normal snowpack in the mountains produced record-high runoff for June at several index gaging stations, without creating any major flooding. The monthly mean discharge of 25,960 cfs on Spokane River at Spokane (drainage area, 4,290 square miles) in the eastern part of the State, was highest for June in record that began in April 1891. Also in the east, on Snake River near Anatone, near the Idaho-Washington border, the stage and discharge observed June 19 were the highest in record that began in 1959. In northwestern Washington, on Skykomish River near Gold Bar (drainage area, 535 square miles), the monthly mean discharge of 13,330 cfs, and the daily mean of 20,700 cfs on the 14th, were highest for June since records began in 1928. In the southwestern part of the State, flow of Chehalis River near Grand Mound decreased seasonally but remained above the normal range for the 4th consecutive month, and for the 7th of the past 8 months (see graph). Monthly mean flows also were

above the normal range in northwestern and south-central Wyoming, in north-central Colorado, in the Kings River basin in the southern Sierra Nevada of California, in West Walker River basin in western Nevada and the adjacent area of eastern California, and in much of Oregon.

In central Colorado, where monthly mean discharge of Arkansas River was above normal during May, the seasonal increase during June was less than usual and the mean flow for the month was below median and in the lower part of the normal range. (see graph).

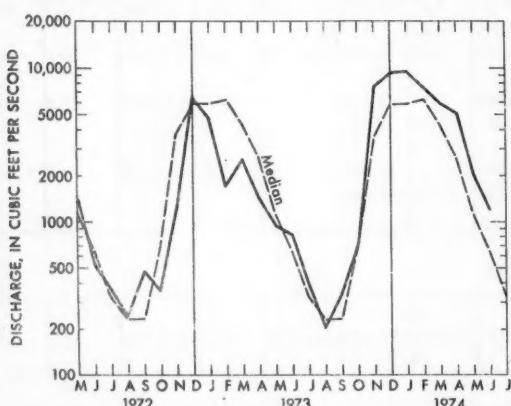


Monthly mean discharge of Arkansas River at Canon City, Colo. (Drainage area, 3,117 sq mi; 8,073 sq km)

Record, or near-record, low monthly mean flows occurred in parts of Arizona and New Mexico during June. In extreme southern Arizona, on San Pedro River at Charleston, the monthly mean of 1.49 cfs was the lowest for any month since records began in October 1913, and the daily mean of 0.8 cfs, June 7, almost equaled the observed low of 0.7 cfs for the period of record. Monthly mean flows were in the below-normal range at all index stations in the eastern and northern parts of that State. In southwestern New Mexico, flow of Gila River near Gila was below the normal range for the 5th consecutive month and in the east-central part of that State, monthly mean flow of Pecos River at Santa Rosa was only 9 percent of the June median and the lowest mean flow in any month since May 1972.

In Utah, mean flows were below the normal range in the southern and northeastern parts of the State. Flow of San Juan River near Bluff, in extreme southeastern Utah, was only 30 percent of the June median, and the flow of Whiterocks River near Whiterocks, in the extreme northeast, was 42 percent of median for the month. Also in the north, the level of Great Salt Lake fell 0.30 foot during the month (to 4,201.00 feet above mean sea level, adjusted for datum correction of -0.10 foot, June 1974), 0.85 foot higher than a year ago, and 2.10 feet higher than the average (1904-70) monthly level for June.

Ground-water levels rose in western Montana, northern and western Idaho (highest in 39 years of record at Meridian), and northern and southeastern Utah; changed only slightly in southern New Mexico; and fell in



Monthly mean discharge of Chehalis River near Grand Mound, Wash. (Drainage area, 895 sq mi; 2,318 sq km)

FLOW OF LARGE RIVERS DURING JUNE 1974

Station number	Stream and place of determination	Drainage area (square miles)	Mean annual discharge through September 1970 (cfs)	June 1974					
				Monthly discharge (cfs)	Percent of median monthly discharge, 1941-70	Change in discharge from previous month (percent)	Discharge near end of month		
				(cfs)	(mgd)	Date			
1-0140	St. John River below Fish River at Fort Kent, Maine.	5,690	9,397	12,950	138	-79	4,750	3,100	30
1-3185	Hudson River at Hadley, N.Y.	1,664	2,791	1,873	81	-69	1,700	1,100	30
1-3575	Mohawk River at Cohoes, N.Y.	3,456	5,450	2,816	92	-67	2,500	1,600	30
1-4635	Delaware River at Trenton, N.J.	6,780	11,360	7,650	109	-47	6,400	4,100	30
1-5705	Susquehanna River at Harrisburg, Pa.	24,100	33,670	16,960	74	-54	14,500	9,400	30
1-6465	Potomac River near Washington, D.C.	11,560	10,640	14,400	194	+35	16,200	10,500	30
2-1055	Cape Fear River at William O. Huske Lock near Tarheel, N.C.	4,810	4,847	3,100	160	-50	2,270	1,500	30
2-1310	Pee Dee River at Peedee, S.C.	8,830	9,098	7,910	134	-24	5,410	3,500	27
2-2260	Altamaha River at Doctortown, Ga.	13,600	13,380	7,134	83	-6	7,210	4,700	23
2-3205	Suwannee River at Branford, Fla.	7,740	6,775	3,990	80	-28	3,880	2,500	22
2-3580	Apalachicola River at Chattahoochee, Fla.	17,200	21,690	14,900	91	-17	11,900	7,700	26
2-4670	Tombigbee River at Demopolis lock and dam near Coatopa, Ala.	15,400	21,700	28,210	440	+16	13,200	8,500	26
2-4895	Pearl River near Bogalusa, La.	6,630	8,533	7,850	220	-34	4,040	2,600	30
3-0495	Allegheny River at Natrona, Pa.	11,410	18,700	8,689	76	-68	8,350	5,400	27
3-0850	Monongahela River at Braddock, Pa.	7,337	11,950	24,690	392	+102	22,400	14,500	27
3-1930	Kanawha River at Kanawha Falls, W.Va.	8,367	12,370	14,890	221	+3	11,000	7,100	28
3-2345	Scioto River at Higby, Ohio.	5,131	4,337	5,536	272	+52	12,900	8,300	27
3-2945	Ohio River at Louisville, Ky. ²	91,170	110,600	158,800	259	+24	283,600	183,000	26
3-3775	Wabash River at Mount Carmel, Ill.	28,600	26,310	58,000	273	+12	72,000	46,500	30
3-4690	French Broad River below Douglas Dam, Tenn.	4,543	6,528	7,118	152	-28	.....	.....	.....
4-0845	Fox River at Rapide Croche Dam, near Wrightstown, Wis. ³	6,150	4,142	7,200	191	+14	.....	.....	.....
4-2643.31	St. Lawrence River at Cornwall, Ontario—near Massena, N.Y. ³	299,000	239,100	327,300	125	+6	330,000	213,000	30
050115	St. Maurice River at Grand Mere, Quebec.	16,300	24,900	64,600	214	-63	35,700	23,100	25
5-0825	Red River of the North at Grand Forks N. Dak.	30,100	2,439	6,026	133	-55	3,600	2,300	30
5-3300	Minnesota River near Jordan, Minn.	16,200	3,306	9,174	166	+81	4,830	3,100	27
5-3310	Mississippi River at St. Paul, Minn.	36,800	10,230	29,100	164	+13	20,600	13,300	26
5-3655	Chippewa River at Chippewa Falls, Wis.	5,600	5,062	7,691	138	+29	.....	.....	.....
5-4070	Wisconsin River at Muscoda, Wis.	10,300	8,457	12,636	129	+11	.....	.....	.....
5-4465	Rock River near Joslin, Ill.	9,520	5,288	19,850	362	-9	17,000	11,000	30
5-4745	Mississippi River at Keokuk, Iowa.	119,000	61,210	183,600	212	+7	218,700	141,000	30
5-4855	Des Moines River below Raccoon River at Des Moines, Iowa.	9,879	3,796	13,100	182	-18	9,660	6,240	30
6-2145	Yellowstone River at Billings, Mont.	11,795	6,754	41,460	157	+335	44,300	28,600	30
6-9345	Missouri River at Hermann, Mo.	528,200	78,480	133,400	122	-8	70,200	45,400	25
7-2890	Mississippi River near Vicksburg, Miss. ⁴	1,144,500	552,700	1,192,000	202	+44	1,125,000	727,000	30
7-3310	Washita River near Durwood, Okla.	7,202	1,379	1,130	67	-61	270	170	30
8-3130	Rio Grande at Otowi Bridge, near San Ildefonso, N.Mex.	14,300	1,530	488	32	-72	.....	.....	.....
9-3150	Green River at Green River, Utah.	40,600	6,369	20,755	115	-3	20,900	13,500	30
11-4255	Sacramento River at Verona, Calif.	21,257	18,370	19,700	186	-17	16,800	10,900	26
13-2690	Snake River at Weiser, Idaho.	69,200	17,670	36,590	149	-6	40,200	26,000	26
13-3170	Salmon River at White Bird, Idaho.	13,550	11,060	84,900	221	+138	86,000	55,600	24
13-3425	Clearwater River at Spalding, Idaho.	9,570	15,320	71,580	195	+89	65,400	42,300	26
14-1057	Columbia River at The Dalles, Oreg. ⁵	237,000	194,000	467,800	103	+31	.....	.....	.....
14-1910	Willamette River at Salem, Oreg.	7,280	23,370	21,580	162	+4	14,500	9,400	26-30
15-5155	Tanana River at Nenana, Alaska.	25,600	24,040	32,530	63	+22	.....	.....	.....
8MF005	Fraser River at Hope, British Columbia.	78,300	95,300	300,000	121	+43	364,000	235,000	27

¹Adjusted.²Records furnished by Corps of Engineers.³Records furnished by Buffalo District, Corps of Engineers, through International St. Lawrence River Board of Control. Discharges shown are considered to be the same as discharge at Ogdensburg, N.Y., when adjusted for storage in Lake St. Lawrence.⁴Records of daily discharge computed jointly by Corps of Engineers and Geological Survey.⁵Discharge determined from information furnished by Bureau of Reclamation, Corps of Engineers, and Geological Survey.

PUBLICATIONS ON TECHNIQUES OF WATER-RESOURCES INVESTIGATIONS

Twenty-nine manuals by the U.S. Geological Survey have been published to date in the series on techniques describing procedures for planning and executing specialized work in water-resources investigations. The information in the manual series is grouped under major subject headings called books and is further divided into sections and chapters. For example, Section B of Book 4 (Hydrologic analysis and interpretation) is on surface water. The chapter, the unit of publication, is limited to a narrow field of subject matter. This format permits flexibility in revision and publication as the need arises. The reports listed below are for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Current prices as shown below are higher for some of the manuals than the prices were at the time of the first printing.

NOTE: When ordering any of these publications from the Superintendent of Documents, please give the title, book number, chapter number, and "U.S. Geological Survey Techniques of Water-Resources Investigations."

- 2-E1. *Application of borehole geophysics to water-resources investigations*, by W. S. Keys and L. M. MacCary: USGS—TWRI Book 2, Chapter E1. 1971. 126 pages. \$1.75.
- 3-A1. *General field and office procedures for indirect discharge measurements*, by M. A. Benson and Tate Dalrymple: USGS—TWRI Book 3, Chapter A1. 1967. 30 pages. \$0.25.
- 3-A2. *Measurement of peak discharge by the slope-area method*, by Tate Dalrymple and M. A. Benson: USGS—TWRI Book 3, Chapter A2. 1967. 12 pages. \$0.20.
- 3-A3. *Measurement of peak discharge at culverts by indirect methods*, by G. L. Bodhaine: USGS—TWRI Book 3, Chapter A3. 1968. 60 pages. \$0.40.
- 3-A4. *Measurement of peak discharge at width contractions by indirect methods*, by H. F. Matthai: USGS—TWRI Book 3, Chapter A4. 1967. 44 pages. \$1.00.
- 3-A5. *Measurement of peak discharge at dams by indirect methods*, by Harry Hulsing: USGS—TWRI Book 3, Chapter A5. 1967. 29 pages. \$0.30.
- 3-A6. *General procedure for gaging streams*, by R. W. Carter and Jacob Davidian: USGS—TWRI Book 3, Chapter A6. 1968. 13 pages. \$0.20.
- 3-A7. *Stage measurements at gaging stations*, by T. J. Buchanan and W. P. Somers: USGS—TWRI Book 3, Chapter A7. 1968. 28 pages. \$0.45.
- 3-A8. *Discharge measurements at gaging stations*, by T. J. Buchanan and W. P. Somers: USGS—TWRI Book 3, Chapter A8, 1969, 65 pages. \$1.25.
- 3-A11. *Measurement of discharge by moving-boat method*, by G. F. Smoot and C. E. Novak: USGS—TWRI Book 3, Chapter A11. 1969. 22 pages. \$0.40.
- 3-A12. *Fluorometric procedures for dye tracing*, by J. F. Wilson, Jr.: USGS—TWRI Book 3, Chapter A12. 1968. 31 pages. \$0.35.
- 3-B1. *Aquifer-test design, observation, and data analysis*, by R. W. Stallman: USGS—TWRI Book 3, Chapter B1. 1971. 26 pages. \$0.70.
- 3-C1. *Fluvial sediment concepts*, by H. P. Guy: USGS—TWRI Book 3, Chapter C1. 1970. 55 pages. \$0.65
- 3-C2. *Field methods for fluvial sediment measurements*, by H. P. Guy and V. W. Norman: USGS—TWRI Book 3, Chapter C2. 1970. 59 pages. \$0.70.
- 3-C3. *Computation of fluvial-sediment discharge*, by George Porterfield: USGS—TWRI Book 3, Chapter C3. 1972. 66 pages. \$1.15.
- 4-A1. *Some statistical tools in hydrology*, by H. C. Riggs: USGS—TWRI Book 4, Chapter A1. 1968. 39 pages. \$0.30.
- 4-A2. *Frequency curves*, by H. C. Riggs: USGS—TWRI Book 4, Chapter A2. 1968. 15 pages. \$0.20.
- 4-B1. *Low-flow investigations*, H. C. Riggs: USGS—TWRI Book 4, Chapter B1, 1972. 18 pages. \$0.65.
- 4-B2. *Storage analyses for water supply*, by H. C. Riggs and C. H. Hardison: USGS—TWRI Book 4, Chapter B2. 1973. 20 pages. \$0.75.
- 4-B3. *Regional analyses of streamflow characteristics*, by H. C. Riggs: USGS—TWRI Book 4, Chapter B3, 1973. 15 pages. \$0.65.
- 4-D1. *Computation of rate and volume of stream depletion by wells*, by C. T. Jenkins: USGS—TWRI Book 4, Chapter D1. 1970. 17 pages. \$0.65

(Continued from page 10.)

western Washington, southeastern Idaho, northern and eastern Nevada, central and southwestern Utah, and southern Arizona and California. Monthend levels were above average in most northern parts of the region; near average in many southern California wells; below average in most of Utah; and far below average in southern New Mexico.

ALASKA

Streamflow generally increased seasonally except in the Chena River basin in east-central Alaska, where flows decreased seasonally and were below the normal range. Monthly mean flow of Chena River at Fairbanks was less than half the June median and cumulative runoff at that site during the first 9 months of the 1974 water year was about 40 percent less than normal. In the southeastern part of the State, flow of Gold Creek near Juneau increased and was more than twice the mean flow during May but remained below the normal range for the 8th consecutive month. In the south-central basin of Kenai River, flow at Cooper Landing continued to be within

the normal range but cumulative runoff at that site during the past 9 months was only 72 percent of normal, reflecting the generally dry conditions prevailing in the southern part of the State. Below-normal temperatures in Tanana River basin, in central Alaska, retarded snowmelt during June, resulting in below-normal runoff at Nenana.

Ground-water levels in the Kenai area were unchanged in the alluvial aquifers and declined in the deep aquifers. In the Anchorage area, levels rose in the foothills (recharge area); and nearer the city, levels declined in both the water-table and artesian aquifers.

HAWAII

Streamflow decreased in all parts of the State and was in the normal range except on the island of Maui where continued lack of rainfall resulted in monthly mean flow at the index station, Honopou Stream near Huelo, that was less than half the June median and in the below-normal range for the 2d consecutive month. Monthly mean flows at that site were less than median during 13 of the past 15 months.

(Continued from page 12.)

- 5-A1. *Methods for collection and analysis of water samples for dissolved minerals and gases*, by Eugene Brown, M. W. Skougstad, and M. J. Fishman: USGS—TWRI Book 5, Chapter A1. 1970. 160 pages. \$2.00.
- 5-A2. *Determination of minor elements in water by emission spectroscopy*, by P. R. Barnett and E. C. Mallory, Jr.: USGS—TWRI Book 5, Chapter A2. 1971. 31 pages. \$0.80.
- 5-A3. *Methods for analysis of organic substances in water*, by D. F. Goerlitz and Eugene Brown: USGS—TWRI Book 5, Chapter A3. 1972. 40 pages. \$0.90.
- 5-A4. *Methods for collection and analysis of aquatic biological and microbiological samples*, by K. V. Slack, R. C. Averett, P. E. Greeson, and R. G. Lipscomb: USGS—TWRI Book 5, Chapter A4, 1973. 165 pages. \$3.85.
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WATER RESOURCES REVIEW

Cover map shows generalized pattern of streamflow for June based on 22 index stream-gaging stations in Canada and 130 index stations in the United States. Alaska and Hawaii inset maps show streamflow only at the index gaging stations which are located near the points shown by the arrows.

Streamflow for June 1974 is compared with flow for June in the 30-year reference period 1931–60 or 1941–70. Streamflow is considered to be *below the normal range* if it is within the range of the low flows that have occurred 25 percent of the time (below the lower quartile) during the reference period. Flow for June is considered to be *above the normal range* if it is within the range of the high flows that have occurred 25 percent of the time (above the upper quartile).

Flow higher than the lower quartile but lower than the upper quartile is described as being within the *normal range*. In the Water Resources Review the median is obtained by ranking the 30 flows of the reference period in their order of magnitude; the highest flow is number 1, the lowest flow is number 30, and the average of the 15th and 16th highest flows is the median.

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The *normal* is an average (but not an arithmetic average) or middle value; half of the time you would expect the June flows to be below the median and half of the time to be above the median. Shorter reference periods are used for the Alaska index stations because of the limited records available.

Statements about *ground-water levels* refer to conditions near the end of June. Water level in each key observation well is compared with average level for the end of June determined from the entire past record for that well or from a 20-year reference period, 1951–70. *Changes in ground-water levels*, unless described otherwise, are from the end of May to the end of June.

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This issue was prepared by J.C. Kammerer, H.D. Brice, T.H. Woodard, J.K. Reid, and L.C. Fleshmon from reports of the field offices, July 9, 1974.

WATER DEMANDS FOR EXPANDING ENERGY DEVELOPMENT

The accompanying abstract and graphs are from the report, *Water demands for expanding energy development*, by G. H. Davis and L. A. Wood: U.S. Geological Survey Circular 703, 14 pages, 1974. The report may be obtained free upon request to the U.S. Geological Survey, Branch of Distribution, 1200 S. Eads St., Arlington, Va. 22202.

ABSTRACT

Water is used in producing energy for mining and reclamation of mined lands, onsite processing, transportation, refining, and conversion of fuels to other forms of energy (fig. 1). In the East, South, Midwest, and along the seacoasts, most water problems are related to pollution rather than to water supply. West of about the 100th meridian, however, runoff is generally less than potential diversions, and energy industries must compete with other water users. Water demands for extraction of coal, oil shale, uranium, and oil and gas are modest, although large quantities of water are used in secondary recovery operations for oil. The only significant use of water for energy transportation, aside from instream navigation use, is for slurry lines. Substantial quantities of water are required in the retorting and the disposal of spent oil shale. The conversion of coal to synthetic gas or oil or to electric power and the generation of electric power with nuclear energy require large quantities of water, mostly for cooling.

Withdrawals for cooling of thermal-electric plants is by far the largest category of water use in energy industry, totaling about 170 billion gallons (644 million m³) per day in 1970 (fig. 2).

Water availability will dictate the location and design of energy-conversion facilities, especially in water deficient areas of the West.

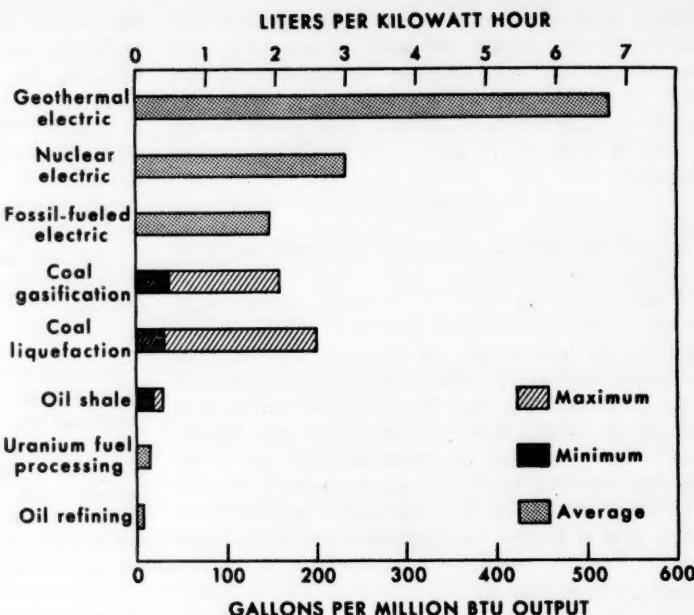


Figure 1.—Water consumption in refining and conversion processes.

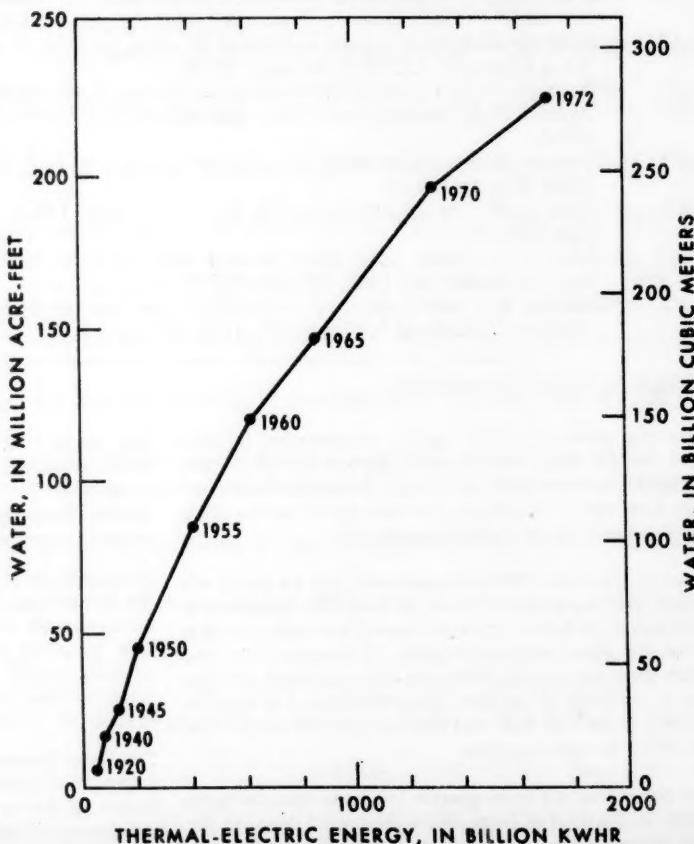


Figure 2.—Annual withdrawals of water for thermal-electric power generation in the United States, 1920–72.





